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II.—*On the Longitude of Valparaiso and Callao, in a Letter from Baron ALEXANDER VON HUMBOLDT.*

Sans Souci, near Potsdam, Sept. 6, 1839.

SIR,—I have long delayed to express the homage of my lively gratitude for your kindness in enabling me so soon to profit by the important observations which enrich the Second Part of Volume IX. of the London Geographical Journal. A journey with the King of Prussia into Bohemia has delayed the renewed expression of my high esteem, and of the always increasing interest caused by reading a journal so rich in original material and so carefully edited.

The too flattering manner in which the President of the Society, Mr. W. Hamilton, has in his excellent address mentioned my trifling and *antediluvian* astronomical labours in tropical America has imposed upon me the task of examining again, and by comparison with new and good observations, the position of some points to which Captain Fitz Roy, in his admirable work (*Appendix to the Voyages of the Beagle*), has attached especial interest. Among the points which I have determined on the coast of the Pacific Ocean, Callao, the port of Lima, is perhaps the most important of all. It is as much so as Cumana, Porto Rico, and Havanah, are in the West Indies. In the luminous and rigorous statement which Captain Fitz Roy has given of the whole of his chronometric determinations, in which, in the entire circuit of the globe, only 33 seconds of time are to be accounted for, to be divided over a great number of separate meridian distances, Captain Fitz Roy says, “Callao, Sydney, and the Cape of Good Hope (*App.* p. 345), are three remote points which might be selected (for comparison), rather than others, because generally supposed to be well determined; if the *Beagle*’s position of Callao be proved incorrect, then must Humboldt’s (calculated by Oltmanns) be also incorrect.”

It will probably be agreeable to you, sir, to be acquainted with the results of some new researches on this point. My longitude of Callao rests, as you know, on the passage of Mercury of the 9th November, 1802. The interior contact, the surer of the two, gave 5h. 18m. 18s.; the mean of the two contacts 5h. 18m. 16s., reckoning always from the meridian of Paris. M. Oltmanns has compared my observation with others made at Greenwich, Paris, Sieberg, Lilienthal, Berlin, Cette, and Copenhagen (Humboldt, *Rec. d’Obs. Astr.*, vol. ii. p. 421-427). A long series of lunar distances taken in the voyage of Captain Duperrey gives 5h. 18m. 16·3s.; Lartigue finds, by distances and chronometric measurements from Quilca, 5h. 18m. 0·7s. (Givry, *Conn. des Temps*, 1827, p. 258); and Captain Fitz Roy decides upon

5h. 18m. 16s. (*App.*, p. 349), resting upon the longitude of Valparaiso. Now, in the expedition of the *Beagle*, 4h. 56m. 7s. is adopted as the longitude of Valparaiso, and for the difference of longitudes between Valparaiso and Callao, 0h. 22m. 9s. Now, 5h. 18m. 16s. is precisely the longitude which the *two* contacts gave me, and 2 seconds of time less than that by the exterior contact of the passage of Mercury in 1802.

The passage of Mercury over the disk of the sun in 1832 having been observed by M. Scholtz at Lima, and at Breslaw by M. Boguslawski, I requested M. Galle, assistant astronomer at the Royal Observatory at Berlin, to calculate the passage.

M. Galle found, for the longitude of Lima,

	h.	m.	s.
	5	17	41·4
	5	17	48·5

mean, 5h. 17m. 45s. Now, I found Lima to the east of Callao (*Rec. d' Obs. Astr.*, tome ii. p. 428), by chronometer,—

				s.
1802,	Nov.	9	.	28·6
„	Dec.	14	.	31·2
„	„	17	.	27·8
„	„	27	.	27·2
				28·7

whence it results that, by the transit of Mercury in 1832, the longitude of Callao is, according to M. Galle, 5h. 18m. 13·7s., while the passage of 1802 gives 5h. 18m. 18s., and Captain Fitz Roy decides upon 5h. 18m. 16s. The accuracy of the determination of the longitude of Callao seems thus, for the last 30 years, to have been circumscribed within sufficiently narrow limits.

As absolute astronomical observations ought to claim attention in preference to relative and chronometric observations, allow me to dwell for a moment on the position of Valparaiso. The occultation of the star, 644 of the Scorpion, was observed on the 28th of October, 1821, with much accuracy, by Captain Basil Hall. Mr. Foster, an observer and calculator generally very exact, accidentally made a mistake in the calculation of this occultation, which gives, not 4h. 55m. 15s., as Mr. Foster thought, but 4h. 56m. 16·6s., for the fort of San Antonio at Valparaiso. M. Oltmanns, according to Bode (*Astronomische Lehrbuch für* 1829, p. 197), in a memoir already written in September, 1826, pointed out the mistake in the calculation by the comparison of the elements. Now, the occultation of Antares* gives 4h. 56m. 42s.: we have, therefore, by the mean of two occulta-

* This occultation of Antares is also an observation of Captain Basil Hall. The observation is good, but the calculation made of it at first was wrong, as is proved

tions 4h. 56m. 29s. = $74^{\circ} 7' 15''$; but, as lunar distances and the satellites give 74° and $73^{\circ} 59'$, M. Oltmanns, in a MS. memoir which he communicated to me shortly before his death, assumes as longitude of Fort San Antonio at Valparaiso, $74^{\circ} 2' =$ 4h. 56m. 8s., which only differs a second in time from the result obtained in the memorable expedition under Captains King and Fitz Roy.

Captain Beechey has published (*Naut. Mag.*, April, 1838) an important result obtained by the moon's passage over the meridian. Fourteen days' observations, compared with Cambridge, Paris, Edinburgh, and the Cape of Good Hope, differ only 27 seconds in time, and the whole of these transits gives 4h. 55m. 59.1s. : 120 lunar distances give Captain Beechey 4h. 55m. 53.4s.; mean 4h. 55m. 56.2s., only 12 seconds of time less than the whole of the occultations, satellites, and lunar distances had given to my friend and colleague, Oltmanns. If we take the mean of the first-class observations only, for Callao of the two passages of Mercury over the sun's disk, for Valparaiso of the two occultations calculated by M. Oltmanns, and of the lunar transits of Captain Beechey, we have—

	h.	m.	s.
Callao . . .	5	18	15.8
Valparaiso . . .	4	56	12.4 *

Difference of longitude 0 22 3.4

which agrees very well with the four chronometric trials of—

	h.	m.	s.
Malespina . . .	5	26	28
Captain B. Hall . . .	5	31	47
Lartigue . . .	5	30	43
Fitz Roy . . .	5	32	15
	0	22	1.4

Perhaps it would be prudent to exclude the result by Malespina as differing the most.

by the comparison of the elements of calculation given by *Bode, Astr. Jahrb. für*, 1828, p. 182. The result is not $71^{\circ} 30' 50.5''$, but $71^{\circ} 51' 25''$ west of Greenwich.

* To remind us how useful it is to submit old observations to rigorous calculations, I will cite the eclipse of the sun of the 11th of March, 1709, observed by Feuillée. This eclipse gave Triesnecker 4h. 56m. 29.4s.; Mechain, 4h. 56m. 33s.; Oltmanns, 4h. 56m. 41s. (Paris). I acknowledge that the longitude which results from the transits by Captain Beechey, generally so worthy of confidence, appeared to me to give a longitude rather too much to the east; for we have now definitively for Valparaiso,—

h.	m.	s.	
4	56	41	Feuillée and Oltmanns.
4	56	7	Fitz Roy.
4	56	29	Occultation of Basil Hall.
4	55	56	Beechey.
			Oltmanns preferred 4h. 56m. 8s.

As astronomical tables are gradually corrected, it becomes necessary to revise former calculations.

I found Cumana by an eclipse of the sun 4h. 25m. 51s.

By chronometers 4 26 4

By the satellites 4 26 6

4 26 0·4

—(*Rec. d'Obs. Astr.*, tome i. p. 86).

On the 7th of November, 1799, I had a good observation of the Imm. II. Satellite, with a very clear sky. This observation, published by Baron von Zach during my journey on the Orinoco, gives, by the tables of Delambre, 4h. 25m. 32s. ; a corresponding observation at Marseilles makes Cumana in 4h. 26m. 21s. This observation of the II. Satellite has just been calculated with the excellent tables of Damoiseau, by M. Wolfers, a very exact and practised calculator. It gives 4h. 26m. 3·9s., which, as a single observation, only differs 4 seconds from the general mean. At this moment there are so few persons who occupy themselves perseveringly, and with the accuracy that the present state of science admits of, with astronomical geography, especially for points situated out of Europe, that you will oblige us much if from time to time you would transmit to me observations for occultations, eclipses of the sun, and of moon-culminating stars, as I have the means here of submitting them to a rigorous calculation.

The volume of Mr. Charles Darwin is an admirable supplement to the voyage of the *Beagle*: it is one of the most remarkable works that, in the course of a long life, I have had the pleasure to see published. Mr. Darwin unites to sagacity for detailed observations enlarged views in general physics, I should rather say in natural philosophy,—views which embrace at once geology, the geographical distribution of plants, and the influence of temperature on the organic types of the primitive world.

It is also fortunate that this great expedition to the southern regions of America should have induced your able geographer, Mr. John Arrowsmith, to compile his beautiful map of the whole of the continent of South America.

I offer up the most ardent wishes for the success of the magnetic expedition under Captain James Ross, and for the establishment of the stations which we owe to the munificence of the British government: if it is true that the letter I addressed to H. R. H. the Duke of Sussex and to the Royal Society has contributed to these undertakings so useful to science, I should congratulate myself on having had the courage to plead so excellent a cause. I hope that Captain Ross has on board the necessary apparatus

for observing magnetic dip at sea, as M. Adolph Erman* and myself have done. As a stratum of water of immense thickness covers the surface of the globe, these observations, being less affected by local perturbations, are of great importance even when they may be made with less precision.

We shall also learn if the showers of shooting-stars from the 10th to the 12th of August, and from the 12th to the 13th of November, are visible far towards the South Pole.

During the last six or eight months I have been daily occupied with the directions of the chains of mountains in Central Asia, and with a new edition of the two volumes of *Fragmens de Géologie et de Climatologie Asiatiques*, which I published after my return from Siberia. There still remains much doubt as to the position and names of the lakes which in the plateau of Pamer are the sources of the Oxus; I know nothing more of the discovery of the Sini-gúl and "Lake Victoria" of Lieutenant Wood, except the few lines contained in the 'Bombay Gazette' and the 'Asiatic Journal' for November, 1838.

Has the Geographical Society nothing more precise on the topography of Pamer, than some astronomical observations of Lieutenant Wood, companion of the courageous Sir Alexander Burnes? This lake, at 15,600 feet above the sea, is of the more importance to me, as, thanks to the kindness of M. Stanislas Julien, professor of Chinese literature at the College de France at Paris, I shall publish a very curious notice on the plateau of Pamer, extracted from the unpublished travels of Hiouentsong, a Buddhist traveller of the 7th century.

ALEXANDER HUMBOLDT.

To Captain Washington, R.N.

P.S.—Mr. Schomburgk continues to explore with the same ardour. I hope that he will reach the Cerro Duida, the forest of *Bertholletia*, and the mission of Esmeralda, where I was almost devoured by mosquitoes. May this excellent young man, my countryman, always enjoy the kindness of your illustrious society!

* M. Erman has described his apparatus in *Schumacher's Astr. Nach.*, 1839, p. 364.